Electric Vehicle Inverters

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Electric Vehicle Inverters - Status

Inverters are already present on certain conventional "specialty vehicles"

- Ambulance / Fire Fighting Platforms
- Recreational Vehicles
- Buses
- Boats / Yachts

"Electrified" vehicles open up new, potentially higher volume opportunities

Electric Vehicle Inverters - Status

Existing conventional vehicle inverters operate off of low voltage and are limited to low power (limits of alternator supply)

- 12 or 24 VDC
- Less than 6 kW

"Electrified" vehicles – battery electric, hybrid electric and fuel cell electric – operate at higher DC bus voltage and have higher power capacity

- 48 to 800 VDC
- 10 to 200 kW on board

Electric Vehicle Inverters - Market

On Road Vehicles

- 110 VAC outlets will become a real selling feature
- Example: hybrid electric “contractor” trucks (GM Silverado)

Off Road Vehicles

- Tend to operate away from readily available power, leading to a real selling feature
- Military, construction, and agricultural vehicles

Electric Vehicle Inverters - Future

- Electric cars and trucks
- Hybrid electric cars and trucks
- “Connected cars” that interface with the grid
- Military hybrids with high capacity inverters
- Agriculture and construction hybrids with high capacity inverters
- Fuel cell vehicles

Vehicle Electrical/Mechanical Characteristics

- Sensitivity to Perturbation – Generally Low
- Stand-alone in most cases
- High Capacity (Continuous, Surge, Overload)
- Dimensions – Size and Weight – needs to be small and lightweight
- Communications (Local/Remote)
- 10 Year, 150,000 Mile, 5,000 Hour vehicle component life requirements
- Cost is the overriding figure of merit

What is Missing from Today's Electric Vehicle Inverters?

- Low Cost
- Small size (for a given output)
- Ruggedness against vibration, shock, and extreme temperatures
- Power capability
- Few products available for this relatively new market

Electric Vehicle Inverter Issues

- Performance – high output in small packages, subjected to difficult environments. The functionality built into existing inverter products is often not required.
- Cost – electric, hybrid electric, and fuel cell vehicles are already too expensive. Present UQM customers have indicated that 6-10¢ per W is required.
- Market share – the market for advanced vehicle inverters is wide open to competitors, many of whom have become tired of waiting for the market to develop and have dropped out.

Developments in EV, HEV, and FCV motor drives can be carried over to 50/60 Hz inverters!